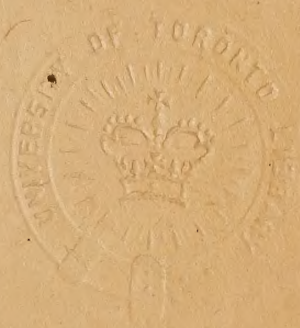
PREFACE

The aim of this memorandum is to give information about edible gelatine that may be of assistance in determining the opportunity Canada offers for the extension of the manufacture of this commodity.

The kind co-operation of the Commercial Intelligence Service of the Department of Trade and Commerce, Ottawa, is gratefully acknowledged.



C O N T E N T S

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EDIBLE GELATINE

(with special reference to the development of Canadian raw materials)

INTRODUCTION

Gelatine is a protein which does not occur as such in the animal body but is derived from the collagen found in the skin, ligaments, and bones. The structure of gelatine has not been definitely determined, and in spite of the progress made in recent years in its chemistry and technology the field for research is still of wide dimension. It has been said that a chemist can work with gelatine for a lifetime and learn something new every day.

Our knowledge of gelatine is not commensurate with its industrial importance; it is only with great difficulty that the pure protein can be prepared; and the best of present practices in commercial manufacture do not even always ensure a product uniform in its properties, as is unfortunately only too well known to the photochemist. Different batches of gelatine are likely to be so uncertain in behaviour that much trouble is frequently experienced in the preparation of photographic films. Nevertheless no better emulsive colloid than gelatine has been found for the photographic industry; millions of pounds of it are used annually in the manufacture of motion picture films in the United States.

Research

Edible gelatine, with which this report mainly deals, is similar to ordinary animal glue but is usually made from cleaner and, preferably, fresh stock, under sanitary conditions, and unlike a technical gelatine it contains only such traces of harmful ingredients as are permitted by the various food laws.

Existing manufacturing processes differ in no marked way from those in use fifty years ago; true, improvements have been

made in plant equipment, in chemical control, and in the method of handling materials, but the principles of the process have not altered. It had long been thought that every avenue that might lead to betterments had been thoroughly investigated, yet research conducted by the Adhesives Research Committee of the British Department of Scientific and Industrial Research has clearly shown that the present manufacturing procedure can be improved without much difficulty and expense to enable gelatine of high quality to be extracted from bones in a much shorter time than is usually considered possible. This Committee has also done important work relating to the utilization of fish as a source of an excellent grade of gelatine.

World Consumption

The consumption of edible gelatine has been steadily increasing, rapidly in some countries such as the United States, Australia, South Africa, and Canada. In the United States the stocks on hand in the latter part of 1926 were the lowest for years; that country at present consumes annually 6,000,000 pounds in ice cream, a like amount in confectionery products, 4,000,000 pounds in the retail package trade, and 500,000 pounds in medicinal and sundry other products. Australia's per capita consumption has doubled in the last five years, and in South Africa and Canada the increasing market for edible gelatine synchronises with the industrial expansion taking place there.

Growing Demand in Canada.

In Canada industrialization is proceeding apace. The 1925 census showed that there were 22,331 manufacturing establishments producing goods to the value of $2,948,545,315. Hundreds of millions of capital attracted from outside have been responsible for this result. Yet Canada is merely at the threshold of a new

for this

era that is expected eventually to rival in prosperity that of the great American republic to the south. New industries are continually being established, and the increase in branch factories of American and British concerns is likely to be even still more rapid. All this is indicative of an expanding domestic market for edible gelatine.

The development of Canada's confectionery industry is having an important bearing upon the demand for gelatine. Prior to 1900 confectionery was manufactured in only limited quantity in Canada, but now there is an export trade of sizable proportion, and one which has been yearly growing.

Despite this industrial growth only one concern appears in the 1927 trade lists of the Canadian Manufacturers' Association as a producer of gelatine. Statistics are not available regarding the extent to which the domestic product is consumed. Replies, however, received from some of the leading Canadian manufacturers of confectionery show that they are using the foreign, not the domestic, product; this is equally true in much of the production of ice cream, a commodity which is consumed in large quantity in Canada and which usually contains about one-half of one per cent of gelatine in the ice cream mix; nor is any gelatine of Canadian origin used in sensitizing photographic papers.

Again, although the business of Canada's large packing concerns has been growing rapidly, the amount of edible gelatine they produce is a negligible percentage of the total amount consumed in the Dominion. In fact, almost all the gelatine they use in the production of jellied meats is brought from outside Canada.

USES OF EDIBLE GELATINE

The uses of edible gelatine are manifold. In foods for general table purposes it is usually found as an ingredient of ice

cream, jelly desserts, custards and puddings, whipped creams, icings, marshmallow coatings, mayonnaise, jellied meats, and soups, while in special dietaries for infants, and for patients who are suffering from tuberculosis, diabetes, or dyspepsia, it has long been used. The confectionery and bakery trades require it for emulsion flavours, meringues and jelly rolls, marshmallows and foams, cream and nougats, icing for coatings, in gum drops and jellied fruits, and in various special breads.

Gelatine is an excellent protective colloid, and this property is used to great advantage in therapeutics and in various medicinal preparations. In the manufacture of capsules, pill coatings, special surgical dressings, and as a clarifier of extracts and as an emulsifying agent gelatine plays important rôles in pharmacy.

Among the many other applications of gelatine of the high grade edible type may be mentioned its use in photography and applied photochemistry; in the manufacture of cocoas and chocolates; as body for toothpastes; for glazing coffee beans; in the production of beer, wine, and many non-alcoholic beverages; in meat extracts, gelatinized milk, fruit preserves, and jams; as a culture medium in bacteriology; and as an aid to drying and to correcting flavours in such products as powdered milk, dried meat extracts, and desiccated fruit-juices.

PRODUCTION AND CONSUMPTION

As already stated, there is only one company in Canada making gelatine in appreciable quantity. This company, which operates at Brantford, Ontario, produces amongst other products both edible and technical gelatines, but the amount of such production is not available. The raw material is obtained mainly from the tanneries, although bones are also used. The bulk of what edible gelatine is made is all sold in Canada to various confectionery, biscuit, ice cream, and jelly manufacturers.

As recently as August, 1927, a company, having a plant at Papineauville, Quebec, was incorporated under Dominion charter with a capitalization of $100,000 to engage in, among other things, the manufacture of gelatine. It is said that this company is now (October, 1927), producing a little edible gelatine from material obtained from slaughter houses.

The output of edible gelatine elsewhere in the Dominion is negligible. One of the meat packing companies produces small quantities from pigskins for its own consumption in the production of jellied meats; and some of the others producing similar jellied products may make a little occasionally but usually import their total requirements from Australia, as this is the only country at this time from which, under existing legislation, supplies of gelatine for use in the Canadian meat-packing plants may be purchased.

The bulk, if not all, of the high grade gelatine used by a number of the principal consumers in Canadian industry comes from foreign sources. One manufacturer of jelly powders and other pure foods alone uses 200,000 lbs of imported gelatine a year, another 175,000 lbs which he obtained from England and France, and two others 100,000 lbs and 30,000 lbs respectively, most of which is of foreign origin.

From a recent private investigation of the grocery trade in some Canadian cities it is adjudged that almost all the powdered gelatine handled by the retailers is obtained from outside Canada, and that, in contrast with the market prevailing for jelly powders, jelly squares, and gelatines three years ago, when a similar retail survey was made, the sales of powdered edible gelatine have rapidly increased, indicating its growing popularity with the housewife. The consumers' demand for sheet gelatine for jelly making is comparatively small.

IMPORTS AND EXPORTS

In the trade returns gelatine is classified with isinglass, but as only very small amounts of the latter are known to be used in Canada, it can be assumed that over 90 per cent of the combined imports of gelatine and isinglass consists of gelatine.

Between the fiscal years 1913 and 1927 the combined imports of gelatine and isinglass have increased from 594,427 lbs, valued at $144,881, to 1,180,306 lbs, valued at $413,549. In 1925 and 1926 the imports amounted to 952,372 and 1,164,857 lbs respectively.

The countries from which Canada made purchases in the years ending March 31st 1927 and 1926 are given in the following table, which also gives the amounts and values of such purchases.

Country	1927 lbs	1926 lbs	1927 $	1926 $
United States	227,298	355,697	171,071	267,298
United Kingdom	355,384	355,546	74,508	79,680
Australia	227,523	161,751	55,622	35,531
France	156,385	90,850	39,204	21,654
Germany	34,511	45,643	24,020	27,830
Japan	25,794	21,163	20,536	22,563
Belgium	69,273	35,523	11,402	6,595
Holland	35,195	47,739	6,199	7,297
New Zealand	24,920	34,216	6,185	9,676
other countries	22,023	16,729	4,802	2,452
	1,180,306	1,164,857	413,549	480,576

In the first three months of the 1927-8 fiscal year 416,383 lbs of gelatine and isinglass, valued at $150,987, were imported, to which Australia contributed 73,480 lbs, valued at $16,667. Canada's purchases from Australia have been steadily increasing during the last few years.

There are no exports of gelatine, edible or technical.

TARIFF

The duty on imports of gelatine into Canada from the United Kingdom is 17½ per cent ad valorem; from Australia and New

Zealand 12½ per cent; and from France and Italy 25 per cent less 10 per cent. The intermediate and general tariffs are respectively 25 and 27½ per cent ad valorem.

THE DOMESTIC MARKET.

The present domestic consumption of edible gelatine is not large but it has been steadily increasing, and a consideration of the possibilities of expansion in the Canadian industries in which such gelatine is now used leads to the belief that this consumption will continue to grow.

Ice Cream

In the manufacture of ice cream probably more edible gelatine is consumed than in the manufacture of any other single Canadian product. Figures compiled by the Dominion Bureau of Statistics show an output in 1925 of 5,895,694 gallons, but this is exclusive of the large unknown amount made in private houses, hotels, and restaurants. The dairy industry produced 3,911,305 gallons, the confectionery plants 1,911,458 gallons, and the bakeries 72,931 gallons.

Based upon a population of 9,269,000 the per capita consumption in 1925 of factory ice cream alone was .63 gallons compared with .54 gallons in 1922.

Although other protective colloids and emulsifying agents are sometimes substituted, gelatine is the customary material used in Canadian ice creams. Ice cream containing gelatine is twice as easily assimilated as ice cream without gelatine. About 1 lb of gelatine is required for every 50 gallons; on this basis the 5,895,694 gallons commercially produced in 1925 consumed 117,914 lbs. Gelatine is also used in the preparation of water ices and sherbets.

In view of the high degree of efficiency attained in modern refrigeration processes it is probable that the market for

Canadian ice cream will be extended. In September, 1927, ice cream made in the United States was shipped from San Francisco to Java in the Dutch East Indies, and Canadian ice cream was sent from Halifax to the British West Indies and as far south as British Guiana.

Jelly and Ice Cream Powders, Powdered Gelatine.

Jelly powder is a principal product of some of the 22 Canadian firms grouped as manufacturers of flavouring extracts by the Dominion Bureau of Statistics. In 1925, the latest year for which official information is available, the output of jelly powders had a selling value of $576,566 compared with $484,547 in 1924. Among other products were flavouring extracts and essences ($649,007), prepared pudding powders ($265,405), egg substitute and egg powder ($145,757), ice cream powder ($11,826), and baking powder ($10,931). The gelatine consumed in the industry amounted to 223,306 lbs in 1925, an amount that exceeded the consumption in 1924 by 71,234 lbs.

Since 1925, however, it is evident that the manufacture of jelly powders and other pure food products like puddings and custard cream powders has been greatly increased for the combined annual consumption of edible gelatine by 4 firms alone, two of which were not listed as manufacturers of flavouring extracts in 1925, is now over 500,000 lbs, according to statements received from them. A little of this gelatine may, however, be sold in powdered form to the retailers. The increasing sales of such gelatine have already been referred to in the section relating to production.

Chocolate and Sugar Confectionery.

The chocolate and sugar confectionery industry is another large consumer of gelatine. Exports of all kinds of sweetened confectionery were valued at only $27,112 in 1913, whereas in the year ending March 31st, 1927, the exports of candy alone amounted to 1,616,078 lbs, valued at $498,590, which is $117,711 greater than it

was two years ago. In 1927 Canada's principal markets for such exports were New Zealand, Newfoundland, and British South Africa.

In 1925 the latest year for which official data are available the domestic production of chocolate confectionery was 61,362,689 lbs, valued at $17,343,447, and of sugar candy 36,333,-514 lbs, valued at $7,935,075, giving a valuation of $25,278,522 for both kinds of confectionery compared with $24,771,237 in 1924. In 1925 there were 252 establishments solely engaged in making confectionery, 20 which combined this with biscuit making, and 29 which made ice cream only.

Imports, however, are still on an extensive scale, those of confectionery coated with or containing chocolate amounting to 2,057,725 lbs, valued at $638,188 in 1927, compared with $145,288 in 1925. The United Kingdom's contribution was 1,735,682 lbs, valued at $549,279 in 1927. In addition, imports in that year of other confectionery, including sweetened gums, candied pop corn, candied fruit, candied nuts, and sweetmeats, were valued at $586,338, compared with $536,294 in 1925. Canada stands sixth in importance among the foreign markets for confectionery made in the United States.

In view of these large imports, it is to be expected that, despite the progress already made, the home industry will be further expanded. This expectation is already being realized to some extent in the establishment now under way (August, 1927) of a branch factory by one of England's well known manufacturers of chocolate confectionery and other products. The amount of gelatine that will be annually required in this factory cannot be forecast till early in 1928.

The favourable outlook for the continued growth of the confectionery industry should be gratifying to the Canadian producer of gelatine and should encourage him to prepare high-grade edible

gelatines which will conform to the specifications of the used thereby enabling him to compete with the foreign manufacturer, who at present is a large contributor to this market.

Some of the Canadian confectionery makers require, so they state, as much as 25,000 lbs of edible gelatine a year, others 2,000 to 10,000 lbs, but many of the balance either none at all or small amounts ranging from 100 lbs to 2000 lbs.

It is to be noted that, although substitutes for gelatine are used extensively in candy making, these are gradually losing ground as the manufacturers come to realize the merits of edible gelatines. In the United States most of the big factories specializing in marshmallows and lozenges use high grade gelatines. This is equally true of the corresponding Canadian factories.

Other Food Products

It is probable that edible gelatine is occasionally used in Canada to impart a better appearance to fruit preserves, jams, and gravies, to give body to meat extracts (reference has already been made on page 5 to the Canadian production of jellied beef and ox-tongues), and to make cream, chocolate, and cocoa seem thicker and richer.

The chewing gum industry uses small amounts. This industry in Canada is expanding; exports have increased from $50,584 in 1926 to $266,706 in 1927, and had a value of $122,123 in the first quarter of the fiscal year 1927-8.

Gelatine will make thin cream easy to whip, will glaze coffee beans, and will prove useful in the baking of raised pies if a thin sheet of it is placed beneath the crust and made to melt slowly. Because it is cheaper than isinglass it has sometimes been used in clarifying certain wines and beverages. Very little of either isinglass or gelatine is now being used by the wine manufacturers in

the Niagara peninsula of Ontario who find that filtering is more satisfactory and quicker.

As part of the normal diet gelatine is of great value, it is an excellent emulsifying agent, and as a protective colloid it is unsurpassed by any other known substance. The value of gelatine in milk for infants is well known; and it has been shown that undernourished children of even 6 to 13 years gained through the use of gelatinated milk in their regular diet a greater weight than when plain milk was so used.

Gelatine is digested more easily than perhaps any other protein, and a small addition of it to certain foods greatly aids their assimilation and absorption; and consequently it is much used in foods for fever, tuberculosis, diabetic and dyspeptic patients. Invalid jellies often contain over 5 per cent of gelatine.

Though gelatine, like most proteins, is an incomplete protein, it functions as a food, is a source of energy, and supplies certain essential amino acids in which other proteins are usually deficient. Some authorities state that the addition of gelatine to the diet in an amount that will give 12 per cent of the required energy reduces the decomposition of body protein by 27 per cent.

Photographic Industry

Silver halide emulsions for coating films, plates, and papers depend as much upon gelatine as upon silver. The very high grade gelatine which is required is prepared with difficulty, and there are very few concerns in the world making it in quantity, perhaps three in Europe and two in the United States.

Large quantities of photographic supplies and equipment are annually imported into Canada; the domestic production of sensitized photographic material, for which 175,000 lbs of gelatine were imported in 1926 (calendar year) from the United States, is reinforced by

imports which had a value of $521,053 in the 1927 fiscal year; and most of the positive films, 1 1/8 or more inches in width, used in the moving picture industry are purchased from outside Canada.

Another class of important photographic material in which gelatine plays a rôle is bichromated gelatine which forms the basis of the carbon process of most of the photo-mechanical printing methods.

Gelatine is used also in the manufacture of sensitized pigment papers, colour filters for filtering light during exposure of photographic plates, and as the ingredient of an adhesive for mounting prints.

Pharmaceutical and Miscellaneous Applications

In pharmacy gelatine is used for the familiar coated pills and capsules. Associated with glycerine it enters into various products such as gelatino-glycerine and glyco-gelatine used for nasal bougies and medicated lozenges respectively; gelatine jelly is a solution of gelatine in glycerine which serves to sooth the hands as well as to mount microscopic sections; glycerinated gelatine is a component of some tooth pastes, of court plaster and ointments; and discs of gelatine containing a little glycerine and a minute quantity of a powerful alkaloid are used in ophthalmology and in hypodermal treatment.

Its value as a protective colloid is taken advantage of in doctors' prescriptions, in medicated wines and lozenges for remedying human ailments, and in precipitating those metallic colloids that are so important in medicine. Its emulsive properties enable it to act as an excellent vehicle of external remedies.

By treatment with formaldehyde formo-gelatine powders can be obtained which are of value for dressing wounds and for the preparation of drug tablets.

The amount of gelatine in the ground, sheet, and flake forms, all of which are in demand, annually consumed by each of the manufactur-

ing pharmacists in Canada ranges from a few pounds to as much as 4000. Some of the manufacturers use foreign gelatine entirely, others both domestic and foreign; a few, who use negligible amounts in their own products, distribute some sheet gelatine in 1 lb packages to the drug trade.

The Dominion Bureau of Statistics states that in 1925 there were 120 plants mainly engaged in making medicinal and pharmaceutical products, and that the value of their output was $13,987,849, of which $3,783,044 represented pharmaceutical preparations and $46,533 medicated wines.

Among miscellaneous applications of good quality gelatine may be mentioned its use for making those cements, sold under various names, that unite glass and china; for studying the behaviour of bacteria; for demonstrating colloidal phenomena; in compositions for printing rollers; in coating microscopic slides; for coloured sheets for toys and theatrical limelights; for colloidal purposes in electrolytes; and in the preparation of plastic materials for making such articles as handles, buttons, and millinery ornaments.

FOREIGN MARKET

The possibility of sharing in the world's export markets for edible gelatine should not be overlooked by the Canadian manufacturer. The markets which appear to offer him an opportunity and to which he might give first consideration are, perhaps, the United States, Japan, South Africa, Mexico, and the Argentine. In the last three there is no domestic production of edible gelatine; South Africa buys mainly from Australia; the Argentine from Germany, France, and Belgium; and Mexico usually from the United States, but in the last year or two increasing amounts have been obtained from Spain. Japan only commenced the production of edible gelatine from bones and hides early in 1927, but the year's output will be insuf-

ficient to meet the growing domestic demands which will probably have to be met by the usual importations from Germany and France. In so far as the United States is concerned, that country now consumes yearly an amount of edible gelatine that exceeds the whole of Europe's present annual output, and, in spite of a domestic production of about 13,000,000 lbs, has been increasing her importations from Europe.

The market for edible gelatine in Europe is much less developed than the American, probably as a result of the smaller purchasing power of the people and their tendency to adhere to staple articles of diet. In consequence, many producers in Holland, Belgium, France, Germany, and the United Kingdom depend largely upon export markets, and some, interested mainly in trading with the United States, have adopted a system of manufacturing gelatine that will enable them to obtain a product to conform to the food laws of that republic, which appears to be the only country that has well defined legislation limiting the amounts of copper, zinc, lead, arsenic, and sulphur dioxide in gelatine which is sold for food purposes. Low grade food gelatines, which would not be admitted into the United States, are consequently sold elsewhere at lower prices in competition with the high class product.

In addition to gelatines and glues of many varieties and by-products of fats, oils, and fertilizers, some of the world's leading manufacturers of gelatine make prepared adhesives and gelatine food products such as granulated jellies, gelatine lozenges, and custard, pudding, and fruit powders.

Most gelatine factories have an entirely distinct department for the manufacture of glue, and one or two have chemical plants for the production of the hydrochloric acid needed.

RAW MATERIALS

According to the regulations of the Food and Drugs Act of Canada edible gelatine is the purified, dried, inodorous product of the hydrolysis, by treatment with boiling water, of bones and certain tissues, such as skin and ligaments, from sound animals, and contains not more than 2 per cent of ash and not less than 15 per cent of nitrogen.

The raw materials may therefore be hide stock, green bone, or ossein, which are the materials commonly used in all edible gelatine plants. The hide stock preferable for the purpose is that of young animals, and it must be fresh and clean. In the United States perhaps 50 per cent of the production of high grade gelatines is derived from calf stock. Green bone should consist of the selected parts of the animals such as knuckles - the most favoured, shoulder blades, ribs, jaws, and feet, and should be processed without delay in order to avoid discoloration and rancidity. Ossein, i.e., demineralized bone, must have firmness and a good colour.

The customary sources of supply of bones and hide stock are the plants of the packing and tanning companies. In countries that have large meat packing establishments and tanneries the gelatine manufacturer can establish his factory near a domestic source of raw material, but even he is frequently compelled to import large supplies to meet his full requirements. One of the largest packing companies in the United States operating a gelatine plant buys large quantities of raw material from other packers; in fact, most of the gelatine plants operated or under the control of American packers and tanners depend to a certain extent upon imports of raw material from foreign countries.

Some of the independent companies in the United States actually import from Europe all the ossein they use. Even the manufacturer in Australia, notwithstanding the large quantity of raw

material available from the slaughter houses and tanneries there, is obliged to import appreciable quantities of tannery fleshings and trimmings, pieces of ox-hides, and face pieces from South Africa, and some from Germany. It perhaps should be mentioned here that at the Australian meat works the heads and legs are cut from the beast before skinning; the skin and sinews from these are then removed at the works, washed, cured, and sold to the gelatine manufacturer. This differs from the practice in Canada and the United States where the hide is usually removed with the leg skins undetached and sold as such to the tanner. This explains why in Australia there is perhaps available a proportionately larger amount of high grade raw material forthe gelatine manufacturer than in either Canada or the United States.

In England, and in Europe generally, there is no large packing industry like that in the United States, Canada, Australia, Argentina, or New Zealand; the supplies of hide-cuttings and trimmings from the domestic tanneries are limited; and what bones are available are usually only suitable for glue. Because of this many European manufacturers of edible gelatine depend largely upon overseas importations of raw materials. And to supply these imports there has been built up in certain countries such as India and South America important industries engaged in the collection and shipment to Europe of bones, acidulated horn piths, and dried cattle sinews. Ossein is made in England from some of these materials and sold to continental manufacturers of gelatine, particularly those in Belgium. One concern in Liverpool was offering early in 1927 ossein at £40 to £50 per long ton, c.i.f., Montreal, packed in bags of 112 lbs., and horn piths containing a slightly larger amount of arsenic at £30 to £40 per long ton.

The keen competition for raw materials which prevailed in the past amongst European producers of glue and gelatine was no doubt responsible for the organization in July, 1926, of a glue syndicate

embracing the United Kingdom, France, Germany, Belgium, Holland, Switzerland, Italy, Austria, Hungary, Yugo-Slavia, Czecho-Slovakia, Poland, and Rumania. This syndicate has established a central agency for the purchase, allotment, and distribution of raw materials to its members, and for the sale of the finished products. In a trade treaty enacted a few years ago between two European countries a special clause was actually inserted in respect to the exportation of bones.

The principal countries exporting untreated bones and the amounts of such exports in long tons in the calendar years 1924 and 1925, as given in the International Year Book of Agricultural Statistics for 1925-6, published by the International Institute of Agriculture at Rome, are as follows:-

Country	1924	1925
British India	81,616	81,860
Argentine	55,662	58,664
China	52,565	------
Holland	8,513	7,637
France	6,930	13,870
Uruguay	5,556	------
Egypt	3,385	2,502
Belgium	1,940	10,926
Brazil	3,518	------
Canada	2,013	2,296
Australia	1,479	1,356
Italy	906	2,406
Germany	1,570	1,554
Algeria	1,056	1,986

Notes. (1) The figures in the table for Belgium and Canada include untreated as well as treated bones (bone meal, ash, etc.). The Australian figures are for the fiscal year ending June 30th, and include re-exports. By no means are all the bones exported by the countries listed above used in gelatine manufacture, an appreciable percentage being used for such purposes as buttons, fancy articles, bone meal, and lime phosphates.

(2) At the present time (Oct., 1927,) the export of bones from France is limited to about 300 tons annually, and

from Belgium is prohibited altogether. Germany is restricted to exportations of 600 tons each to Holland (under the Dutch-German trade agreement) and to Switzerland.

Tropically sun-dried bones from India are superior, so it is declared, to ordinary cattle bones from the slaughter houses and commanded in July, 1927, a price of $41.50 to $53.50 a long ton in European ports compared with about $34 for cattle bones from packing houses. The cost of shipping bones from India might prove too excessive under existing freight rates to make the manufacture of gelatine from this raw material economical in Canada.

In Belgium, France, Holland, and Germany over 90 per cent of the bones used in edible gelatine manufacture comes from India, yet these countries, and specifically Holland, are able to export with profit gelatine to various countries overseas, including both the United States and Canada. In 1925 Holland contributed 1,635,563 lbs to the 3,171,490 lbs of edible gelatine imported into the United States.

The foregoing facts have been mentioned to stress the point that an appreciable percentage of the world's production of gelatine actually comes from countries dependent upon overseas imports of raw materials. There has been a tendency to deprecate the manufacture of edible gelatine in countries not possessing a sufficiency of domestic supplies of hide stock and bones; and this, with the seemingly inevitable comparison that is always made between Canada and the United States - where the meat packing and tanning industries are on a larger scale and the supply of raw material therefore greater, perhaps explains why a proper consideration has not always been given to the question of increased manufacture of high grade gelatines in Canada.

The Meat Packing Industry.

From the view point of a domestic supply of raw material this Dominion has advantages not generally possessed by European countries. For it has a great packing industry, which in 1926 ranked third among the industries of Canada with an output valued at $167,127,091. This industry is expanding with the Dominion's development; it was only a few months ago when another abattoir and packing plant with a capacity of 1000 head of cattle a day began operations for the first time. In the province of Manitoba the industry is second to agriculture in importance, yet there has not been any extensive development of the numerous subsidiary industries usually associated with packing houses, much of the waste material being shipped to the United States, as also is the present practice of some of the packing companies in eastern Canada.

Important slaughtering and meat-packing establishments are distributed throughout the Dominion; they are to be found at such strategic points as Halifax in Nova Scotia, St. Stephen and St.John in New Brunswick, Montreal in Quebec, Toronto and Kitchener in Ontario, Winnipeg in Manitoba, Regina in Saskatchewan, Calgary and Edmonton in Alberta, and Vancouver and New Westminster in British Columbia. Of the 73 plants all told in 1926 eighteen (6 in Ontario, 5 in Quebec, 2 in Manitoba, 3 in Saskatchewan and Alberta, 2 in British Columbia) had an output each of $2,000,000 or more in value, and thirteen (8 in Ontario, 2 in Manitoba, 2 in Saskatchewan and Alberta, 1 in British Columbia) of between $1,000,000 and $2,000,000. These 73 plants do not include establishments whose chief or only products are animal oil or fats, and from which in 1926 were sold 511,256 lbs of glue, valued at $30,675, and 408 tons of bones, worth $11,299.

The following statistics for the calendar year 1926 are further indicative of the magnitude of the meat and packing industry of Canada, and are helpful in gauging the extent of the domestic

supply of raw material which probably could be made available from this source alone for the manufacture of gelatine.

	No.
Beeves slaughtered	693,290
Sheep and lambs slaughtered	543,891
Hogs "	2,681,305
Calves "	334,398
Bones (raw, ground, etc.) sold (tons)	4,901
Gelatine sold (lbs)	18,758
Glue " "	nil
Glue stock " "	nil

In the same year the exports of bones (crude) from the slaughtering and meat-packing industry and from all other sources in Canada amounted to 1,919 tons, valued at $70,374, and of glue stock to 69,452 cwt. with a value of $90,460. In the 12 months ending March 31st, 1927, these figures were 1,992 tons for bones, and 71,281 cwt. for glue stock. Almost all these exports went to the United States.

The amount of bones yearly exported will probably tend to diminish because the domestic demand for fertilizer and poultry feed is increasing. One large packing company, which operates mainly in western Canada and which occasionally exported a car-load of bones to the United States, expects from this year (1927) onwards to distribute its entire annual production of about 500 to 600 tons of bones and sinews in the home market.

The number of animals slaughtered in the meat packing plants and elsewhere in Canada during 1926 was 9,153,915 made up as follows:-

	No.
Cattle	1,523,116
Calves	500,014
Swine	5,782,147
Sheep	1,011,479
Lambs	337,159
	9,153,915

Sixty-seven per cent of the above total consisting of hogs, there may be a tendency to assume that appreciable domestic supplies of pig skins would be accessible to a Canadian producer of edible gelatine; this assumption, however, would not be altogether justified

because the hog generally raised in Canada is not of the American corn fed type but is a bacon hog, which has a thin hide only occasionally removed, wholly or in part, for the fresh meat trade and certain curing operations.

A few years ago some of the leading Canadian packers intimated a willingness to save all the suitable raw material they had for any manufacturer of gelatine if they had reasonable guarantees that such raw material would be regularly taken at a satisfactory price by the manufacturer. The recent merger of some of the important packing companies in eastern Canada should simplify the arrangement of any necessary working agreements between the packers and the producer of gelatine.

Tanning Industry

In addition to the packing plants Canada's tanneries offer an important source of raw material in hide fleshings and trimmings. In 1926 there were 108 tanneries in operation, of which 51 were in Quebec and 41 in Ontario; the value of their products was $27,747,-605, which exceeded the average during the 5 year period 1921-5 by $3,227,289. Over 80 per cent of the output comes from Ontario where large tanneries occur at such places as Huntsville, Bracebridge, Kitchener, Acton, London, Newmarket, Kingston, Oshawa, Oakville. Barrie, Toronto, and Owen Sound; in Quebec most of the 51 tanneries are small, the one at Ste.Hyacinthe, however, ranking among the more important in the Dominion.

The following statistics give the number of skins tanned in 1926:-

Cattle hides

Foreign	710,970
Domestic	942,623
	1,653,593

Calf and kip skins		
	Foreign	663,334
	Domestic	304,022
		967,356
Goat skins	Foreign	31,205
	Domestic	200
		31,405
Sheep skins		
	Foreign	74,972
	Domestic	63,384
		138,356

The production of glue stock in Canadian tanneries amounted to 22,070,878 lbs, valued at $147,579; this compares with 14,717,886 lbs in 1923 and with 23,245,503 lbs in 1924. Tanning trimmings from some imported hides which have been dehaired and cured with lime and arsenious sulphide are unsuitable for edible gelatine manufacture because the arsenic is retained and cannot be readily eliminated.

Summary

From the foregoing it is evident that Canada has a domestic source from which an appreciable quantity of raw material could be derived for the manufacture of edible gelatine and is, therefore, at a decided advantage over those countries that depend almost entirely upon overseas imports.

The raw material which would probably be obtained in greatest supply would appear to be bones, then hide trimmings, and small quantities of sinews, horn piths, and dentelles (waste bone from button factories). Pig skin, which is one of the materials used in the United States for the manufacture of edible gelatine, is not readily available in Canada; it yields 22 to 25 per cent of its weight of gelatine of a higher jelly test than that made from calf stock or ossein, in addition to some grease as a by-product.

Sheep skins

Goats

Deerskin

Domestic 50
31,400

Ossein can be profitably manufactured only from certain kinds of bones, about 60 per cent of the bones obtained from packing houses being estimated suitable for this purpose. Horn piths and the inner bone core of the horns are an important source of ossein. The yield of ossein from 400 lbs of bones is 100 lbs, from which 60 to 65 lbs of an excellent gelatine, light in colour and of high strength, can be made. In converting bone to ossein, phosphatic fertilizer can be obtained as a by-product. Plants using pig skins can also use ossein but usually are not equipped to use calf stock, because this must be limed, a process requiring many vats.

Calf stock, which consists mainly of hide cuttings from tanneries and packing houses, is probably not available in Canada in sufficient quantity to supply other than a small sized gelatine factory. Calf stock usually arrives at gelatine plants, fresh, salted, or limed; it yields about 15 per cent of its weight of gelatine. Imported calf skin that reaches the gelatine plants in the United States is dried limed stock. Gelatine from calf skin is the best and clearest, so it is declared.

Small amounts of raw material suitable for some grades of gelatine can probably be obtained from the fur dressing, felt, button and hat making establishments.

FISH SKINS AS RAW MATERIAL

The result of research, conducted by the Adhesives Research Committee, leads to the belief that it is commercially feasible to prepare from selected fish skins an edible gelatine, or a gelatine suitable for photographic purposes, at a cost much below that at which such gelatines are now obtainable. The Committee has already developed a method (described in Appendix III of the Second Report of the Adhesives Research Committee) whereby a colourless, odourless, and

tasteless cake gelatine can be prepared without great difficulty. The process has been protected by a patent (No. 235,635) in England, and applications have been filed abroad. All rights in the process have been acquired by the Lynn Manufacturing Co., 28, Basinghall St., London, E.C. 2.

According to Dr. J.C. Kernot, who has been in charge of this research work, the most suitable skins for use in this process are those of the cod, haddock, ling, flat fish, and fishes of the family to which such species as sharks, skate, and rays belong. If care is taken in the manufacture, an almost pure gelatine which readily sets and is entirely free from taste or odour can be obtained from the skins of these fish. Skins like those of the cat fish, containing large quantities of fat, are not suitable because they give glues that are dark and set with difficulty; the fat would have to be removed in a preliminary treatment.

The supplies of raw material for such a process will have to be sought in the waste from the filleting factories. The amount that could probably be procured from such a source in Canada is at present small, but should increase as the country progresses and a more extensive development of the enormous fisheries resources takes place to enable Canada both to enlarge her exports and to meet her population's expected increased demand for fish, the present per capita consumption of which is only about one-third of that in England. To ensure a supply of skins throughout the year a portion of the skins obtainable from filleting factories during the season of greatest activity could be dried and stored.

The filleting industry in Canada is almost entirely confined at present to Nova Scotia where there are 63 establishments in each of which a certain amount, quite small in some cases, of fish is prepared as fresh fillets, smoked fillets, or boneless (trade name for salted fillets).

The following figures, compiled by the Dominion Bureau of Statistics, will perhaps assist in determining the extent to which certain species of fish are now being filleted in Canada:-

	1925	1926
Cod		
Fresh fillets	1,773 cwt.	2,043 cwt.
Canned	1,946 cases	2,935 cases
Smoked fillets	51,493 cwt.	75,475 cwt.
Boneless	24,829 cwt.	29,315 cwt.
Haddock		
Fresh fillets	2,298 cwt.	4,002 cwt.
Canned	5,543 cases	14,734 cases
Smoked fillets	12,666 cwt.	16,934 cwt.
Hake and Cusk		
Fresh fillets	437 cwt.	----
Smoked fillets	6,537 cwt.	4,042 cwt.
Boneless	297 cwt.	1,178 cwt.
Herring		
Boneless	697 cwt.	1,022 cwt.
Pollock		
Smoked fillets	-----	318 cwt.
Boneless	-----	44 cwt.

The recorded output of fish skins in Canada in 1926 was 6,942 cwt. to which Nova Scotia contributed 6,662 cwt.

Dr. Kernot makes a suggestion for extending the supply of raw material in England that should apply equally to Canada. Certain species of the fish referred to above are not now landed by Canadian fishermen because they are considered unfit for human consumption; if they were, they would constitute a valuable source of skins. Of course those portions of the fish not used for gelatine and glue manufacture would have to be converted into fish meal, the manufacture of

which is a sine qua non for economical operation of such an industry.

The output of fish meal in Canada is mounting rapidly, particularly on the Pacific coast, and so are exports to Europe; the present time would therefore be opportune for considering the above suggestion. Moreover there is no reason why Canada should not eventually become an exporter of skins and compete with Norway in supplying this material to the fish glue manufacturers in the United States.

The utilization of fish sounds in the production of gelatine is dealt with on page 35.

SECONDARY RAW MATERIALS

In the manufacture of edible gelatine much water is required, sometimes millions of gallons a day. This water should have a low salt content, be free from bacteria and as pure as possible; distilled water is advisable if not a necessity. Softening the water is of value only in so far as it produces a bright and sparkling water or reduces the number of bacteria. Sterilization has frequently to be resorted to and this can be done by any of the processes applicable to water for drinking, but care must be taken to use only the minima necessary of substances like chlorine because these harden the stock; any excess of such substances must be eliminated.

Other secondary materials of importance are sulphurous acid, hydrochloric acid, and lime and other alkalies. The manufacturer, however, of various grades of gelatine may require in addition formaldehyde, bone charcoal, blood or egg albumin, phosphoric acid, and alum. All of these substances are made in Canada from domestic materials with the exception perhaps of sulphurous acid which is now largely made from imported sulphur.

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Other secondary materials of importance in sulphur[illegible] acid, hydrochloric acid, zinc dust and [illegible]. Ammonium [illegible], some urea, [illegible] alkali, phosphoric acid, formalin, boric acid, [illegible] alkali, phosphoric acid, and [illegible] are [illegible] from [illegible] materials with the exception possibly of sulphuric acid which is not largely used for these purposes.

Needless to say the purity and condition of the atmosphere in which the operations are carried out plays a most important part in ensuring an edible gelatine low in bacteria count.

PREPARATION

There are numerous minor modifications of the processes used for making gelatine, each manufacturer ascertaining for himself the details of the methods which he finds most satisfactory, but none of the processes differs in essential principles from that described in any modern text book (q.v.) on the subject.

Nevertheless, the manufacture of gelatine, from bones in particular, offers ample scope for research, and the recent work in this connection of J.C. Kernot and N.E. Speer should be consulted (see pp. 17-22 of the Second Report of the Adhesives Research Committee). As a result of investigations on bone gelatines these authors, who experimented with commercially degreased bones, made the following suggestions:-

(a) The bones should always be macerated in alkali before extraction in the pressure tanks.

(b) In the digestor treatment of undecalcified bones, prior to their being extracted with pre-heated water, high pressure for short periods is preferable to low pressure for long periods. Air pressure gives the best results, but if steam has to be used, it should be as dry as possible.

(c) The time necessary to raise the pressure in the digester to the required degree and the time necessary for releasing the pressure should be as short as possible, and to obtain this the use of a small digester is advisable.

It has already been stated that Kernot and Speer have found that an almost pure gelatine can be obtained from certain fish skins. The process as outlined in the Second Report of the Adhesives Research Committee is briefly this:- the skins are first thoroughly washed, then macerated with very dilute alkali; the alkali is removed by a second washing followed by maceration in very dilute acid and then with water again. The skins thus prepared are extracted in the same way as is employed for skins of higher animals, except that a lower temperature, about 60°C, is sufficient for the digestion.

COMMENTS ON FACTORY PROCEDURE

Despite the success which can be achieved through the handling of materials by modern machinery and through the application of scientific control to each step in the manufacture, some gelatine producers still adhere to antiquated methods, operate irregularly, and are continually in difficulties because they fail to observe strict cleanliness and to make those physical and chemical tests that are so essential if uniform batches of edible gelatine are to be derived from raw materials of variable quality.

An edible gelatine plant should have large ground space where there is no possibility of the air becoming polluted by the smoke and wastes of near-by industries; ample supplies of pure water should at all times be available, as 2,000,000 gallons a day are sometimes required for processing 10 tons of hide trimmings; and the factory should be well arranged and equipped with modern machinery to minimize hand labour in the movement of materials. Provision is often made for the manufacture of other grades of gelatine, gelatine products, and such by-products as refined fats and oils, fertilizer, and animal charcoal.

Uncontaminated raw materials are imperative, and the plant should be scrupulously clean and capable of being maintained

so without difficulty, otherwise an undesirable gelatine of high bacteria count will be the result. To obviate metallic and other impurities the equipment must not corrode, and all secondary materials used must be as free as possible from deleterious elements.

Process steam and electricity should be produced on the spot or perhaps purchased from a near-by power plant. Adequate shipping facilities are of course essential.

In some modern plants the liquors from the extraction tanks, after they have been clarified and filtered through cellulose pulp, are led into a double-effect evaporator, whence the concentrated solution is made to flow on to a conveyor belt passing through a chamber cooled by air blown from refrigerating coils. The solidified jelly is cut by machinery and delivered on to nets of cotton or aluminium wire, placed on trucks for transference to a wooden tunnel-dryer. This tunnel is sometimes 250 feet long and 6 to 8 feet high and wide, and is fed with air that has been heated by coils to a temperature of from 95° to 100°F depending upon the humidity. After about 12 hours the gelatine is dry enough to be crushed, ground, and sized, and when it has been tested for jelly strength, viscosity, bacteria count, and metallic impurities, it is ready to ship in paper-lined wooden barrels, bags, or tin-lined boxes. Edible gelatine should always be stored in a dry cool atmosphere.

When bleaching is necessary, it is done during clarification by some manufacturers, after concentration by others. In many gelatine houses sulphur dioxide is no longer added in any of the operations. Clarification is usually effected by egg albumin, although cows' blood or charcoal is used for some grades of gelatine.

From time to time attempts are made to modify the customary manufacturing process. Methods of drum- and spray-drying have been applied to the concentrated liquors, but the gelatine usually loses its glass-like appearance and is bulky to handle; the prevention of

dust is also a difficulty. Drying is rapidly effected, however, and hydrolysis of the gelatine is thereby prevented.

In Germany a pearl form of gelatine has been obtained by forcing the concentrated liquor through spinnerets into a liquid or gaseous hydrocarbon medium which is afterwards cooled. Sheppard and Eberlin recently patented a method for obtaining cake gelatine heavier than water by compressing the voluminous powder derived from spray dessication.

In converting bone into ossein, phosphoric acid is sometimes used in place of hydrochloric acid, but its action is slower and almost three times as much is required. On the other hand commercial hydrochloric acid has the disadvantage that it usually contains iron and other impurities. Gelatine can be prepared in less time from ossein or from pig skins than from other raw materials.

Some authorities maintain that the boiling operation should be conducted in a slightly acid solution, others in a neutral solution. Although gelatine is less sensitive to acids than to alkalies, it has been stated that even very small amounts of alkali or acid, either left in the tissue or introduced with the extracting fluid, have deleterious effects on the product. Enzymes or bacteria also decompose gelatine.

The grease in bones is removed preferably by a volatile solvent, the choice of which is determined mainly by local considerations of price; Scottish shale naphtha is commonly employed in England, and benzine in the United States. Extraction of the grease is perhaps best conducted under vacuum, and the bones should not contain more than 10 per cent of water; such degreased bones are in excellent condition for storing. It has been suggested that bones should be treated, prior to the extraction of grease, with boiling alcohol in order to remove all the water and the free fatty acids as these cause partial hydrolysis and decomposition of the glycerides in the grease.

GRADES OF GELATINE

Commercial gelatines have amounts and proportions of carbon, hydrogen, nitrogen, oxygen, and sulphur that vary according to the raw material whence they are derived. In addition they contain foreign materials, which enter in during manufacture. An average characteristic high grade edible gelatine would probably contain 49.50% carbon, 6.75% hydrogen, 17.90% nitrogen, 25.00% oxygen, .71% sulphur, and traces of copper, lead, zinc, sulphur dioxide, and sometimes arsenic; the fat would be negligible, and the ash less than 1.5%.

Unfortunately, from the standpoint of both manufacturers and consumers, gelatines are not definitely graded; in order to meet specifications or to control factory operations they are usually tested for some or all of the following: moisture, jelly strength, viscosity, hydrogen-ion concentration, bacteria count, ash, foam ability, and metallic impurities. Their taste, colour, and odour are important factors, as is also their clarity in solution.

Gelatine manufacturers in the United States, however, have standardized a method of determining the jelly strength that is based upon the Bloom gelometer. Gelatinization depends upon the strength of the solution, the hydrogen-ion concentration, the temperature, and the purity of the gelatine; any salts in the water in which the gelatine is dissolved may affect the jelly. Gelatines made from bones are usually inferior in jelly strength to those made from hide pieces or ossein.

The viscosity is also used as a criterion for grading. According to Stadlinger (v Chem-Ztg. 1927, 51,507-8) the Engler viscosity value is more satisfactory than the water absorption test in determining the quality of the gelatine.

Gelatine for Confectionery

As gelatines vary much in strength and in their ability to enter into combination with sugar, the grade of gelatine a manufacturer purchases has to be determined by the product he makes. When required in confectionery gelatine is usually examined for water, ash, water-absorption power, fatty matter, and acidity. Some Canadian confectionery makers demand a gelatine conforming to very stringent specifications and have had difficulty in finding sources of supply. The marshmallow manufacturer must select a gelatine with good whipping qualities; these are best at the iso-electric point. The gelatine must be low in bacteria, otherwise the marshmallow will become sour or the gas evolved by the bacteria will destroy its texture and flavour; this is especially so in hot weather.

Gelatine for Ice Cream

Gelatine for ice cream should of course be low in bacteria count; it should also be tested for ash, moisture, swelling, and, above all, for its effect on the standing up properties of ice cream at room temperature - this last is best determined by making a small batch of ice cream and examining its behaviour. An average analysis-- the work of the North Dakota Food Commission-- of 15 samples of ice cream gelatines used in the United States showed 13.66% water, 1.66% ash, and 14.84%[x] nitrogen. The less the quantity of gelatine necessary in an ice cream mix, the less is the destruction to the flavour imparted by natural fruits; it is advisable therefore to use a high grade gelatine because its protective action is superior to that of lower grades of edible gelatine, which contain proteoses

[x] Equivalent to 17.53% N on dry ash-free basis.

Chapter IV

The Search for Certainty

[illegible] the search for certainty [illegible] the [illegible] the [illegible] the

and peptones in greater quantity. However, care must be exercised to ascertain the proper percentage of such high grade gelatine required because, if in excess, it has a much greater effect than a like excess of a lower grade on the viscosity of the ice cream mix and on the melting resistance, body, texture, and flavour of the finished ice cream. Too much gelatine yields a plastic mix that is heavy and soggy.

Gelatine for Photography and Bacteriology

In regard to photographic gelatine, which is the highest grade of gelatine although it may or may not conform to the specifications of food gelatine, all that can be definitely stated from the point of view of its chemical analysis is that chlorides and metallic impurities like copper, lead, and iron should exist in negligible quantity; grease, mucins, organic sulphur, and substances that reduce ammoniacal silver nitrate in the dark should be absent, and the ash should not exceed 1 per cent. Its suitability depends also upon its physical properties; these are controlled mainly by the hydrogen-ion concentration, which in some photographic gelatines corresponds in a 1 per cent solution to a p_H between 5 and 6. The jelly strength and viscosity are especially important; the latter determines the viscosity of the emulsion and thereby the coating speed. But perhaps the only trustworthy test is the actual application of the gelatine to emulsion making, for any variation, however slight, in the gelatine has a great effect on the results obtained.

Some gelatines are photographically inactive, others less active or relatively inert. The sensitizing property has been traced to minute quantities of organic isothiocyanates and thiocarbamides, and specifically allylmustard oil and allyl thiourea.

The application of electro-osmosis to the purification of gelatine has resulted in a product, so it is claimed in Germany, that

is eminently suitable for photographic purposes.

For bacteriological research gelatine must be clear and bright, the slightest opalescence being objectionable; it must also be nearly neutral and have high jelly strength.

COSTS

Cost data relative to the production of edible gelatine in Canada are not available. In the United States the cost in 1925 ranged from a low of 29.17 (a) to a high of 48.49 (b) cents a pound for the different domestic producers; details of these costs follow, each item being given in cents per lb of gelatine made.

	(a)	(b)
Raw material	14.54	20.75
Factory expense		
Chemicals	2.02	0.95
Labour (direct)	3.42	6.03
Superintendence	.35	.46
Repairs and maintenance	.31	1.76
Heat, light, and power	2.18	6.50
Containers	.28	.55
Other factory expense	.29	2.64
Total factory expense	8.85	18.89
General administrative expense		
Officers' salaries	1.85	.....
Office salaries & expense	.62	.54
Taxes	.09	.64
Insurance	.26	.96
Depreciation	.08	2.03
Other general administrative expense	1.43	2.15
Total general administrative expense	4.33	6.32
Total manufacturing cost	27.72	45.96
Credit for by-products	....	.91

be nearly neutral and have high [illegible] strength.

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ranged from a low of [illegible] to a high of [illegible] (

for the [illegible] domestic [illegible] data [illegible]

each item [illegible] given in [illegible]

Raw material	.54	20.7%
Factory expense		
Chemicals	8.02	.5%
Labour (di[illegible]	8.4[illegible]	.0[illegible]
Supervision and	.35	.4%
Repairs and maintenance		1.7%
Heat, light, and [illegible]	[illegible]	
[illegible]		
[illegible]		
[illegible]		
[illegible]		
[illegible]		
[illegible]		
[illegible]		
[illegible]		
Other [illegible]	1.4	.1%
Total [illegible]	[illegible]	[illegible]
Total manufacturing [illegible]	[illegible]	[illegible]
Credit for by-product[illegible]	[illegible]	[illegible]

	(a)	(b)
Net manufacturing cost	27.72	45.05
Interest on investment computed at 6% on fixed assets (depreciated value) plus inventories	1.45	3.44
Net manufacturing cost	29.17	48.49

The above cost data are exclusive of charges for interest actually paid and of selling expenses, but include interest at 6 per cent on investment.

PRICES

Trade journals do not quote prices. The selling value of over 75 per cent of the edible gelatine produced in 1925 in the United States ranged from 29.53 to 49.52 cents a pound. These prices are, of course, much lower than those prevailing during the war when they ranged from 70 to 90 cents a pound for a grade corresponding to the present grade of 150 gram jelly test, although they compare favourably with the range of from 22 to 30 cents during 1912-14. In the first 6 months of 1926 the weighted average sales value of the output of gelatine in the United States was 40.09 cents a pound, the weighted average jelly test being 159 grams. Present prices (November, 1927) are perhaps a little lower. In November, 1927, one of Canada's leading dealers in chemicals was quoting gelatine powder, which was recommended for ice cream making, at 39 to 42 cents a pound.

OTHER GELATINES AND CERTAIN GELATINE SUBSTITUTES IN COMMERCE

Isinglass

Isinglass, which is derived from the sounds of fish, the sturgeon in particular, is really collagen, which changes rapidly into gelatine when gently warmed with water. This material was used at one time in the preparation of edible jellies and confectionery, but high grade animal gelatine, which is much cheaper and entirely satisfactory, has almost completely superseded it. Its present

	(a)	(b)
[illegible] manufacturing cost	[illegible]	27.75	46.05

applications are chiefly in pharmacy, in the textile industry, and in the making of certain high grade adhesives.

Isinglass is more efficient than bone gelatine for clarifying beverages such as cider, wines, and malt liquors, but its use even in this connection is diminishing because excellent and quick methods of filtering have been introduced. It is still commonly used, however, in the clarification of white wines.

When prepared from the sounds of fish other than sturgeon isinglass usually has a disagreeable odour. The Adhesives Research Committee has evolved a method, however, whereby this drawback has been removed and has obtained an isinglass from the swimming bladders of hake, cod, ling, and haddock, equal in practical value to that from sturgeon.

The only fish from which sounds are now being saved in Canada for use in the production of isinglass is the hake; in some years other sounds have been occasionally saved. There are about 35 concerns or individuals in the maritime provinces (Prince Edward Island, Nova Scotia, and New Brunswick) engaged in preparing dried hake sounds, and their combined output in the year ending March 31st, 1927, was about 25,000 lbs. These sounds are all exported to the United States; there is no isinglass factory in Canada.

Again, it has been known that in France skate skins, which have been treated in some special way, have been successfully used in the clarification of wines. Dr. Kernot of the Adhesives Research Committee has been conducting research to find out this special process and what chemical treatment must be applied to the skins of cod, haddock, and ling to make them serve the same purpose and it has recently been stated that he has been successful.

Agar-agar, Algin, Irish Moss

Agar-agar is the term applied to the dried gelatinous material extracted from certain species of red sea-weeds. Unlike animal gelatine it is not a nitrogenous substance. It is sometimes called Japanese gelatine or vegetable isinglass.

Prior to the recent establishment of a plant in California, Japan was the sole producer and exporter of agar-agar. This commodity has become increasingly important as new uses have been discovered for it; the Japanese product has long been used as a food in China, chiefly as a basis for soups, and the lower grades have been sent to Europe and America for use in medicine, in sizing textiles, in the manufacture of candy (especially marshmallows) and jellies, as a thickener in milk, ice cream and other foods, and as a substitute for egg-white. And notwithstanding the growing output in the United States, imports into that country from Japan have advanced to over 450,000 lbs annually.

Agar-agar makes an excellent medium for use in biochemical research and for bacteria cultures - especially at blood heat. It has been used, so it is stated, as successfully as casein, albumin, collodion, or gelatine in the preparation of certain photographic emulsions.

Algin is a gelatinous derivative from some brown sea-weeds; it is an organic acid, which is said to be useful in foods as a substitute for gum arabic or gelatine and in pharmacy as an emulsifier of oils and an excipient of pills.

Carrageenin is obtained from the Irish moss which grows in abundance on the rocky portions of the North Atlantic coast; it is sometimes used as a clarifying agent in the manufacture of oil and beer and for some purposes to which gelatine is applied.

Gum Arabic and other Vegetable Gums.

Gum arabic is the dried gummy exudation from certain plant species found mainly in Africa. It is used medicinally as an emulsifying agent to hold insoluble drugs in suspension and as a vehicle for powerful alkaloids, but its importance is chiefly as a source of adhesives. It sometimes substitutes gelatine in confectionery.

There are other related gums of an inferior type which are used for similar purposes and often found as adulterants of gum arabic.

Gum tragacanth from Turkey and Persia and karaya gum from India are often used in ice cream and in candies; the Persian product of the former is of particularly good quality and in demand for medical and confectionery uses. Milk solids, gelatine, gum tragacanth, or a high grade of india gum, used in conjunction with agar-agar give the best results in the manufacture of water ices and sherbets.

EDIBLE GELATINE IN CERTAIN FOREIGN COUNTRIES

United States

In the United States definite legal regulation is in force with respect to the purity of edible gelatine, which is defined as that grade of gelatine conforming to the requirements of the U. S. Bureau of Chemistry under the Pure Food and Drugs Act, particularly in relation to the content of bacteria, metallic impurities, and odour. Under this act the maxima permissible of copper, zinc, lead, arsenious oxide, and sulphur dioxide are 30, 100, 20, 14, and 350 parts respectively in 1,000,000. The strictest law in force is in Pennsylvania; this excludes lead and added sulphur dioxide.

There are twelve manufacturers of edible gelatine with a combined production capacity of approximately 21,000,000 lbs a year.

Their output was 12,535,100 lbs in 1925, 15,473,200 lbs in 1926, and 10,398,800 lbs in the first 6 months of 1927. About 60 per cent of the output comes from plants in the Atlantic coast district. Both packers and tanners operate plants or control subsidiary companies which make gelatine. Such plants, 5 in number, produce between 60 and 70 per cent of the total manufactured, the output of the 2 packing companies exceeding that of the tanners. Three concerns manufacture the ossein they use, others import it mainly from Belgium and Austria. The independent gelatine manufacturers procure their raw material from domestic packing and tanning companies and also from foreign sources. The gelatine plants of even some of the packers and tanners are dependent upon imports of additional raw material or upon supplies secured in the open market.

The principal raw materials used are pig skins, calf stock, and ossein, together with small quantities of sinews, horn piths, and dentelles. The calf stock consists mainly of hide cuttings, fresh, salted, or limed; imported calf skin arrives as dried limed stock. Pig skins are delivered from packing houses in a frozen condition.

Imports of all grades of gelatine increased from 3,163,707 lbs in 1922 to 4,795,130 lbs in 1925, and were 4,508,592 lbs in 1926. Imports of edible gelatine alone increased from 2,818,377 lbs in 1923 to 3,119,709 lbs in 1925, were 2,420,857 lbs in 1926, and 1,546,754 lbs in the first 6 months of 1927. In 1925 only 21,759 lbs of the imports had a value of 40 cents or more a lb. The countries contributing largely to the imports of edible gelatine in that year were Holland, Germany, Belgium, and France, which supplied respectively 1,635,563, 689,511, 439,287, and 267,708 lbs valued at $280,506, $169,175, $86,928, and $74,873.

Gelatine exports, which are not subdivided into edible and other grades, were 261,712 and 461,483 lbs in 1923 and 1925 respectively. Canada's purchases, mainly the edible and photographic

varieties, increased from 155,454 lbs in 1923 to 230,487 lbs in 1925, valued in the latter year at $156,760. England was the second chief purchaser in 1925 with 81,237 lbs, valued at $61,861, followed by Australia with 31,904 lbs and Mexico with 30,952 lbs. The exports of all grades of gelatine in 1925, the year of greatest exports, were slightly less than 3.7 per cent of the domestic production of edible gelatine alone.

The present annual consumption of edible gelatine in the United States is estimated at 16,500,000 lbs. Probably 90 per cent of the commercial ice cream produced contains gelatine. The United States consumes much more food gelatine than any other country in the world, England perhaps ranking next, followed by Canada, France, Germany, and Australia, in that order. The market in America is distributed geographically in approximately the same proportion as the population.

United Kingdom

All but 10 per cent of the producers of gelatine in the United Kingdom are members of the Federation of Hide, Gelatine, and Glue Manufacturers. Statistics of production are not available; an unofficial estimate, however, places the total consumption of edible and technical gelatine at about 13,000,000 lbs a year.

The absence of large meat packing concerns in England makes it necessary to supplement the limited supply of domestic raw material with overseas imports, which consist largely of uncut and crushed bones, acidulated horn piths, and dried sinews. Uncut bones consist of jaws, skulls, ribs, and knuckles, which have been degreased; the type preferred is the knuckle bone which commanded a price of $34 to $39 a long ton, c.i.f., Liverpool, in December, 1926. Dried sinews without bone and packed in bales brought from $48 to $87 a long ton, depending upon the grade.

In some English districts the tanners have combined to form subsidiary companies to make gelatine, thereby being enabled to use much more profitably their hide trimmings. One of these combinations was offering in January, 1927, edible gelatine, complying with the Pure Food Act, at about $607 per long ton in bulk, less 2½ per cent discount for cash in 30 days, f.o.b. Bristol, packed free. Some tanners work up independently their own hide pieces, others sell to paper makers who make size for their own consumption.

Edible gelatine is marketed in both powdered and sheet form, the latter probably predominating. Prices for the four standard qualities ranged early in 1927 from $398 to $607 per long ton. Some English manufacturers of confectionery and ice cream use Belgian gelatine for which they pay from $272 to $496 a ton. The consumption of gelatine in the production of ice cream, though small, seems to be increasing.

The manufacture of gelatine in England is sometimes associated with the production of gelatine products. One of the leading producers makes, in addition to edible and technical gelatines, food products such as water-leaf jellies, fruit puddings, custard powder, granulated jellies, creams, and lozenges, all in various flavours.

Imports of all grades of gelatine into the United Kingdom amounted to 2,728,992 lbs in 1925 compared with 2,168,992 lbs in 1924; the unrevised figures for 1926 indicate imports of 2,769,312 lbs. In 1925 the bulk of the imports came from Belgium, France, and Germany, which contributed respectively 1,242,752, 510,272, and 449,344 lbs, valued at £61,140, £30,800, and £30,070.

Exports of domestic gelatine in 1925 were 761,488 lbs, valued at£72,518, Canada, South Africa, and Australia being the leading purchasers from the point of view of quantity with 151,872, 91,616, and 78,064 lbs, valued at £8,171, £6,585, and £6,414 respectively. France purchased only 52,192 lbs, valued, however, at

£11,298. In 1926 exports, based upon unrevised figures, amounted to 711,088 lbs, valued at £68,910.

Food regulations in England prohibit the use of all preservatives in gelatine except sulphur dioxide, which must not exceed 1000 parts in a million. The same regulations prohibit the addition to foods for sale in the United Kingdom of colouring matters containing antimony, arsenic, cadmium, chromium, copper, mercury, lead, or zinc. The maximum of arsenic usually permitted is one-hundredth of a grain per pound or per gallon according as to whether the food is solid or liquid.

A United Kingdom manufacturer contemplating a branch factory in Canada is sometimes at a decided disadvantage compared with the American manufacturer. The latter is usually thoroughly conversant with trade conditions in Canada and is merely extending to that country the production of an article which he is already selling in the United States and which, by reason of climatic and other conditions, is equally suited to the requirements of Canada. Moreover he benefits when in Canada by the British preferential tariff of that country, a benefit that the British manufacturer already possesses. On the other hand, the United Kingdom manufacturer has usually been making for years a type of article primarily adapted to the particular requirements of the United Kingdom and of European countries, whereas the similar article in common demand in Canada may be sufficiently different to necessitate a radical alteration in production methods. The British manufacturer usually has a somewhat limited knowledge of Canada and, in addition to this handicap, is frequently compelled to seek another source for his raw materials when operating in a field far removed from his existing plant.

Australia

The manufacture of high-grade gelatine is mainly in the hands of one company, which has a plant near Sydney producing annually,

so it is stated, more edible gelatine than any other factory in the world. This plant, which is regularly inspected by the Government, covers a large acreage and enjoys a reputation for cleanliness and attractive surroundings replete with facilities for the employees' amusement.

It produces more than 60 grades of gelatine and glue; various manufactured products, such as special adhesive pastes and gelatine lozenges; and a number of by-products including fats, oil, and fertilizers.

The raw materials consist mainly of the skins and sinews derived from the heads and legs of animals slaughtered at the Australian meat works. The insufficiency is made up with importations from South Africa, India, and sometimes Germany.

Efforts are being made by the company to secure a site in Melbourne for the erection of another factory.

Glue and a little gelatine of the industrial type are also made by the principal tanning company in the commonwealth, but merely as a comparatively small side-line.

The annual domestic consumption of edible gelatine has risen from 2.63 ounces per head of population in 1921 to 5.16 in 1926. One of the largest producers of ice cream in Australia uses about 11,200 lbs of edible gelatine a year.

Imports of gelatine of all kinds amounted in 1924-5 to 257,930 lbs, valued at £30,992, the principal contributing countries being the United Kingdom, Belgium, the United States, France, and Japan with 91,114, 60,991, 38,736, 35,387, and 26,298 lbs respectively. Exports of gelatine and glue of all kinds in the same period had a value of £26,990, which compares with £18,201 in the corresponding period 1923-4. In 1924-5 Canada's purchases were valued at £7,793 compared with £2,786 in the previous year. Exports to South Africa rose in value from £9,991 in 1923-4 to £13,119 in the

succeeding year. The export prices for gelatine average £112, or about $565 in Canadian currency, a long ton.

New Zealand

The company that is the main producer of gelatine in Australia now controls almost the entire output of edible gelatine in New Zealand through its plant at Woolston, near Christchurch, which is famed for the beautiful garden of roses surrounding it. In addition to other grades of gelatine this plant produces glue and by-products.

The production of gelatine has increased from 167.7 tons in 1923 to 190.25 tons in 1926. The capacity of existing plants is more than sufficient to meet domestic needs.

Imports in 1926 amounted to 38.95 long tons and exports to 30.75 tons.

Edible gelatine is used in New Zealand mainly in confectionery manufacture, only to a limited extent in ice cream, the consumption of which is small.

The principal raw materials are leg and face pieces, sinews, and hide trimmings, obtained from the domestic meat-freezing works, abattoirs, and tanneries; in addition recourse is had to importations from Australia and India.

Holland

In the 1926 annual report of Holland's important and only producer of edible gelatine, reference is made to the keen competition and concomitant decline in prices which have been experienced in the past few years in the marketing of gelatine. Nevertheless, because of the improved quality of its product, the company looked with confidence on the future, despite additional difficulty in the form of competition from manufacturers of bone-lime which arose early in 1927,

resulting in a diminution of the supplies of Dutch bones available for gelatine and in a greatly enhanced price for this raw material. The company procures bones also from India and Germany.

The factory, typically Dutch in its cleanliness, manufactures glue and technical and edible gelatine; all the hydrochloric acid used in converting bone into the intermediate material, ossein, is made, together with salt cake as a by-product, in a separate department of the plant. Precipitated bone phosphate is obtained as a by-product of ossein manufacture and is sold principally for use as a fertilizer, which commands a price closely related to that of superphosphate or of Thomas phosphate powder.

In 1926 Holland imported 231,117 lbs of gelatine, of which Germany supplied 96,406 and Belgium 78,912 lbs. Exports amounted to 1,460,692 lbs, valued at 684,685 guilders; of these the United States, the United Kingdom, Belgium, and Canada received 1,204,526, 107,556, 56,907, and 32,998 lbs, valued respectively at 511,834, 47,702, 70,369, and 13,200 guilders. The foregoing figures compare with imports of 205,029 lbs and exports of 2,255,308 lbs in 1925.

The domestic consumption of ice cream, although increasing, is negligible compared with that in Canada. This also applies to the Dutch consumption of many comestibles in which gelatine is commonly used in Canada; and therefore the bulk of Holland's output of food-gelatine has to seek foreign outlets.

France

The glue and gelatine industry of France comprises 50 to 60 factories. The present production of gelatine is greater than it was prior to the war, but the output of glue is probably smaller.

Imports of gelatine decreased from 224,672 lbs, valued at 1,811,000 francs, in 1924, to 106,400 lbs, valued at 2,278,000 francs, in 1926; but exports during the same period rose from 1,507,744 lbs,

valued at 7,478,000 francs to 1,516,928 lbs, worth 15,248,000 francs. In 1922 the French exports of all grades of gelatine only amounted to 975,315 lbs.

In 1924 Great Britain, Belgium, the United States, and Switzerland, in that order, supplied all but 7,168 lbs of the imports, and the exports in that year were distributed mainly among Great Britain, the United States, and Belgium.

French gelatine has a good reputation, and in its preparation the manufacturers depend largely upon calf and ox bones. Owing to the insufficiency of domestic raw material France procures raw cattle bones from British India, Argentina, and Great Britain. In 1926 the net imports, that is, the excess of imports over French exports of bones, amounted to 5,273.7 tons compared with 6,759.7 in 1925 and 16,669.7 in 1924. A portion of the bones imported is used in the manufacture of buttons and fancy goods.

Edible gelatine is used in the preparation of jams, custard cream powders, jellies, gravies, pharmaceutical pills, and for the clarification of wines and liquids. Housewives usually make themselves any gelatine they require. Ice cream consumption is small, and gelatine is little used in its manufacture.

Gelatine is marketed in various forms, blocks, sheets, tablets, powder, and flakes; the bead form, which was produced originally in Germany, is occasionally made to order.

In January 1927 export prices of edible gelatine ranged from approximately 1040 to 1900 francs per 100 kilograms (i.e. 224 lbs).

Belgium

Belgium holds a prominent position in Europe as a producer of edible gelatine. Although confirmatory statistics of production are not available, the output has increased rapidly since the war,

mainly as a result of the erection by the Société Générale Belge de Produits Chimiques of a new food-gelatine plant at Ghent. This plant, one of the largest gelatine factories in the world, is equipped with the most modern machinery; is uniquely situated on 22 acres of ground with railway sidings; and has water on both sides - enabling oversea steamers to discharge at the factory door. In 1925 the output of this concern was about three times what it was in 1924.

Belgian gelatine is now produced chiefly in sheet form and the tendency seems to be to decrease further the output of the powdered variety. Prices in March, 1927, ranged from 20 to 24 cents a pound.

The raw material comes mainly from India, although waste from domestic tanneries is used to a small extent. In 1926 the imports of bones amounted to 39,630,425 kilograms, valued at 65,242,985 francs (about $2,040,000), of which India supplied 97.5 per cent.

The quantity in pounds and the value in dollars of the imports and exports of gelatine, edible and technical, in 1926 were as follows:-

	Imports		Exports	
	lbs	$	lbs	$
Powdered gelatine	112,706	32,000	37,724	3,200
Sheet gelatine	274,960	113,000	1,931,538	153,000
	387,666	145,000	1,969,262	156,200

Holland supplied about 50 per cent, Germany 31 per cent, and France 17 per cent of the value of the imports of powdered gelatine; Finland and Austria together received almost all the Belgian exports of gelatine in this form. Of the other imports Germany supplied 37 per cent by value, Great Britain 31 per cent, France 13 per cent, and Switzerland 16 per cent. The Belgian exports of sheet gelatine went almost entirely to the United Kingdom.

follows:-

Germany

Statistics of production are not available. In 1926 imports of gelatine of all kinds amounted to 103,040 lbs compared with exports of 2,490,880 lbs. All the imports came from France, and the bulk of the exports went to the United States and the United Kingdom, which took 1,417,920 and 418,880 lbs respectively, Canada receiving only 56,000 lbs. The total exports of all grades of gelatine increased from 1,583,564 lbs in 1922 to 2,490,880 lbs in 1926.

Gelatine products, such as capsules, consecrated wafers, dry photographic plates, and goods made of gelatine but not containing sugar, were exported to the amount of 210,560 lbs, valued at $445,238, the recipients being the United Kingdom, the United States, and Italy. There were no imports of commodities of this class.

In the first quarter of 1927 imports of gelatine were 253,120 lbs, all from Belgium, having a value of $66,905, and exports 423,360 lbs, valued at $333,095.

The raw materials are imported chiefly from the Argentine and India. When bones are used the first step in the German gelatine factories usually involves the production of ossein, which, if low enough in arsenic, is used for making edible gelatine, otherwise for technical gelatines.

Gelatine is marketed in both sheet and powder, the former predominating. In May, 1927, the export prices of edible gelatine in sheets, 22 by 8 cms., ranged from £88 "10"0 to £162 per long ton, f.o.b., Hamburg, packed in bags of 112 lbs; prices for the higher grades, powdered, were 5 per cent greater.

Mexico

Gelatine is not produced in Mexico. The imports in 1925 were 145,965 lbs, valued at $54,577 (in Canadian currency); of these

approximately 134,400 lbs consisted of edible gelatine, which was used almost entirely in the manufacture of ice cream and candy confectionery, and for household purposes. In 1925 the principal countries contributing to these imports were the United States, Germany, France, and Belgium with 59,723, 47,479, 17,266, and 12,526 lbs respectively; during the past two years, however, Spanish gelatine has become much more popular, and Germany and Spain are now the principal sources of Mexico's supply.

It is stated by an importer that whatever the origin of the gelatine a label printed in French is generally preferred as this suggests to the buyer a superior product. Packing is usually in one pound cartons, these being again packed in cases containing 224 packages. The import prices in March, 1927, for silver and gold gelatines from Germany were respectively $0.90 and $1.09 per kilogram, c.i.f., Vera Cruz; those for similar varieties from Spain were 550 and 575 pesetas per 100 kilograms, f.o.b., Barcelona. Because there seems to be a prejudice against the powdered form, almost all gelatine is marketed in sheets.

In Mexico city is manufactured a glue from bones that is used as a substitute for technical gelatine; this explains why about 90 per cent of all imports of gelatine consists of the edible grade.

India

Although India does not manufacture edible gelatine she is the world's leading exporter of raw material used in the European production of that commodity. This raw material is in the form of cattle and water buffalo bones, the exports of which are classified in India's trade returns under (a) crushed bones (b) uncrushed bones (c) bone meal. In the years ending March 31st, 1925, 1926, and 1927 the exports in long tons were:-

	1925	1926	1927
Crushed bones	36,079	44,650	52,955
Uncrushed bones	545	389	599
Bone meal	34,363	39,258	45,601
	70,987	84,297	99,155

Of the 99,155 tons exported in 1927, Belgium, the largest purchaser, took 40,285 tons, but an appreciable tonnage of this amount was used for purposes other than the manufacture of gelatine.

The imports of gelatine, both technical and edible (for they are not separately classified), amounted to 83,776 pounds in the year ending March 31st, 1926, compared with only 38,528 pounds in the corresponding period, 1925. In April, 1927, the imports were 3,136 pounds, compared with 6,160 pounds in April, 1926.

The consumption of ice cream in India is insignificant, and the amount, if any, of edible gelatine used in its manufacture is quite small. Ice cream is obtainable in some hotels and restaurants, but people in private houses have to make what they require.

Japan

The Japanese manufacture of bone and hide gelatine, edible and technical, commenced early in 1927, and the production, which is largely in the hands of one firm, although there are many small firms, will probably be about 140,000 lbs during the year, an output insufficient to meet the domestic demand. All the raw materials are obtained locally.

Imports in 1926 amounted to 329,279 lbs, valued at 255,303 yen, to which Germany and France contributed 146,951 and 128,102 lbs valued respectively at 101,549 and 79,118 yen. This imported gelatine is usually in sheets averaging 8" x 3", about $\frac{1}{4}$" thick at the ends, and 1/8" at the centre. The small quantities of powdered gelatine imported are used in the grocery trade.

Argentina

No edible gelatine is manufactured in the Argentine and what little of any other grade, by some of the packing companies, is apparently not sold on the local market.

Imports, mainly from Germany, France, and Belgium, of edible and technical gelatine amounted to 74,142 lbs in 1925 compared with 83,741 lbs in 1924. The bulk of these imports probably consists of the edible variety, which is used in the manufacture of ice cream.

Raw material suitable for the production of edible gelatine is shipped abroad by the packers. There are 11 important meat packing plants, 5 of which are controlled by American, 4 by British, and 2 by Argentine capital.

South Africa

There is no production of edible gelatine in South Africa. Imports, in both sheet and powder forms, amounted in 1925 to 338 884 lbs, valued at £21,512; Australia was the main source of supply with 196,086 lbs, followed by Belgium, the United Kingdom, and France with 71,937, 42,359, and 13,367 lbs respectively. In addition 208,158 lbs of gelatine for industrial purposes were imported. The combined imports, which have been steadily increasing, of edible and technical gelatine were 88,071 lbs greater in 1925 than in 1924.

One company, through its plants in Australia, New Zealand, and England, handled over 70 per cent of all South Africa's imports of edible gelatine in 1925, and has the bulk of the retail trade.

Although not a producer of gelatine, South Africa has raw material available at her tanneries in the form of fleshings and trimmings, pieces of ox-hide, and hide face pieces. Quite a business has been developed in collecting and drying this material for shipment, mainly to Australia. Bones, however, cannot be economically

exported because the cost of ocean shipments is too great.

In South Africa edible gelatine is used chiefly for jellies, confectionery, ice cream, pill coatings, and for the baking and biscuit industry. With the exception of a negligible quantity of other material, pure gelatine is the only colloid legally permitted in ice cream making.

Technical or lower grades of edible gelatine are used in the wine and printing industries, and by plasterers for moulding.

In February, 1927, the prices of an average quality of gelatine used in confections, jelly powders, and ice cream, ranged from £5 "0 "0 to £6 "5 "0, better qualities from £6 "5 "0 to £7 "10 "0, and photographic gelatine about £10 "0 "0, all prices being for 112 lbs, c.i.f., Cape Town.

DUTY IMPOSED BY FOREIGN COUNTRIES ON IMPORTS OF CANADIAN GELATINE

The following information, giving in brief the duty which would be imposed by various countries on any edible gelatine coming from Canada, is based upon data obtained in August, 1927, from the Foreign Tariffs Division of the Commercial Intelligence Service of the Department of Trade and Commerce, Ottawa.

Australia

On gelatine of all kinds 6d. per lb, or 45% ad valorem, whichever is the greater; on jelly crystals and jelly powders 5d. per lb; and on gelatine in packages for retail sale 30% ad valorem.

The value on which the duty is levied is the selling price to the Australian importer or the price of similar goods when sold in Canada, whichever is higher, increased in either case by 10%.

The duty on gelatine imported into Australia from the United Kingdom and New Zealand is lower, because the Australian British preferential tariff applies to those countries but not to Canada.

New Zealand

On edible gelatine 20% ad valorem, and on concentrated jellies 4d. per lb, together with, in each case, the customary primage duty of 1% ad valorem, which is levied on most imports whether they are liable to duty or not.

The ad valorem price is the fair market value, increased by 10%, which the edible gelatine would command if sold in Canada.

Canada enjoys New Zealand's British preferential tariff schedule.

Union of South Africa

5% or 20% ad valorem according as to whether the gelatine is in bulk or not; in the case of the former there is an additional suspended duty of 15% ad valorem, but this has not yet been enforced.

Gelatine for use in the confectionery and biscuit industries is not dutiable.

The above tariffs apply to all countries.

Belgium

On edible gelatine in powder form 60 francs per 100 kilograms, if in sheets 100 or 200 francs per 100 kilograms according as to whether or not they are iridescent. The Belgium franc may be taken equivalent to 2.78 cents in Canadian money.

The above tariffs apply to all countries.

Holland

8% ad valorem, whether in sheets or powder.

Germany

The general tariff, which applies to Canada, is 10 reichsmarks per 100 kilograms. The German reichsmark is equivalent to 23.8 cents in Canadian currency.

France

On gelatine in powder, in leaves, or in plates, the tariff applicable to Canada is 15% ad valorem, the general and minimum tariffs are 20% and 5% ad valorem respectively.

United States

On edible gelatine valued at less than 40 cents a lb, 20% ad valorem plus 3½ cents a lb; valued at 40 cents or more a lb, 20% ad valorem plus 7 cents a lb.

Mexico

15 centavos per legal kilogram plus 12% of the duty; this is equivalent to about 3 3/4 cents per lb in Canadian money. Legal weight means that the interior wrapping is included with the weight of the gelatine.

United Kingdom

No duty.

Japan

16.30 yen per 100 kin; this is equivalent to about $5.80 per 100 lbs in Canadian money.

Argentina

On gelatine used for meats the duty is 5% of the official valuation, viz., 1.04 pesos, placed on each kilogram of such gelatine; this is equivalent to about 2¼ cents a lb in Canadian money. On other edible gelatine the duty is 32% of the official valuation, viz. 1.12 pesos per kilogram, and is about 16 cents per lb in Canadian money.

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